

AVIATION WEEK

A MCGRAW-HILL PUBLICATION

MAY 30, 1949



Cross-Wind landing wheels automatically caster through an arc of 15° left or right permitting ship to weathervane into relative wind while wheels roll directly down the runway.

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The Goodyear *CROSS-WIND* Landing Wheel

Today, DC-3's can operate successfully in and out of *single-strip* airports, regardless of wind direction, thanks to the new Goodyear Cross-Wind landing wheel. Developed for the CAA by

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controls
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of aviation.



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trols, Standard on Many Types
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You can't select finer, more dependable
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AXELSON FIRST CHOICE



TOP FLIGHT

AVIATION EXECUTIVES AGREE that Axelson engineering and plant facilities for the production of high precision aircraft components are among the finest available.

FOR PRECISION AIRCRAFT PARTS

such as landing gears, hydraulic struts, hydraulic actuators, gear boxes, transmission, superchargers and variable speed drives, absorber drives, and pressure regulator valves, Axelson is considered first choice by world leaders in aircraft manufacturing.

Axelson is currently producing airframe parts for sales presentation of the Douglas DC-4 transport. Numerous Axelson experimental projects are under way in design stage, production stage, and in actual operating units. Axelson engineering resources constantly endeavor to provide more efficient equipment, combining economy with better quality.



AXELSON

MANUFACTURING COMPANY

AIRCRAFT DIVISION

6150 South Ray's Ave.
Los Angeles 11, Cal.

AVIATION WEEK

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Gilfillan adds these features to GCA*



GCA: An original masterpiece of the GCA radar landing system, Gilfillan is proud to have pioneered its development for the USAF. Under research and production contracts from the Air Force, US Navy and GCA, Gilfillan has greatly simplified and improved GCA as a full-scale aid to military and civil aviation. New developments by Gilfillan are indicated by America's leading electronic scientists as equal to GCA itself.



High-powered Search: Early GCA ranges were limited to a "soft" intermediate area 12 miles out and 4000 feet up. With high-powered modern circuits, this area was inadequate. Gilfillan improves the search system to extend solid surveillance to an altitude of 20,000 feet over a 30 mile range. Now searchers view the extension of the search area even more clearly and accurately than Gilfillan keeps GCA pushed to today's needs.



New Goals: Gilfillan's new standard equipment gives GCA the lower down from the field station unit. Now GCA is applied to regular tower operations as a compass, navigation tower console. Gilfillan employs today's finest, single-channel equipment (100W 4), with today's modern single operator equipment. Consolidation of all GCA functions into the two-scope, one-man console is one of Gilfillan's latest advances.

RCA INTERNATIONAL DIVISION
EXCLUSIVE EXPORT DISTRIBUTORS

*Under Contract Approval



NTI: Top-Gilfillan contribution to GCA is the addition of Non-Terrain Indicator. As GCA penetrates into core weather to reveal all targets, NTI penetrates and so penetrates ground clutter from the scope to show only moving targets. GCA no longer requires the tedious concentration of a ground operator. Exact position of every search is now instantly ready. Gilfillan was first to produce reliable, high-speed, range-indicator NTI.



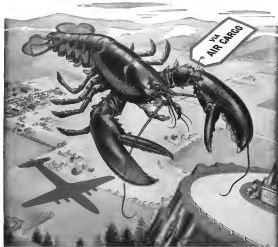
Asit Scope: Clear, exact picture of search appears instantly in three dimensions on the Gilfillan Asit Scope. This picture data, accurate to 4-15 feet, is referred to the pilot who uses it as a full-scale navigation aid. Given his precise position, the pilot can make corrections for drift, instrument lag and pressure changes immediately. An added innovation, GCA uses the pilot without further retarding his vision and light path.



World-Wide: 36 Gilfillan technical experts supervise GCA at USAF bases the world over. Gilfillan installed GCA overseas for TWA, AGA, and TWA, and TWA, and in Canada for the RCMP. GCA built by Gilfillan for the GCA is now to be in operation soon to coast. Gilfillan schools today GCA users for the GCA, USAF and RCMP. Supporting all phases of GCA at airports serving the world is standard Gilfillan procedure.



Gilfillan
LOS ANGELES



Succulent Supper... *En Route*

► Early this morning this lobster was twenty fatheads under the Atlantic. Tonight it will provide the main dish at the Brown Palace Hotel in Detroit... all because of modern high-speed air cargo transport.

► Air cargo delivers food, medicine, clothing... needed supplies of every kind... in hours instead of days. This, too, has passenger transportation, are vital services also airlines offer American business.

► Heavy loads of goods or men or even one joyride... and Sperry equipment helps airlines stay on schedule regardless of weather or visibility... helps maintain the schedule reliability so important to air cargo carriers.

► Today, many airlines equip their cargo... in day do their passenger transports... such... the Sperry A-12 Gyrocompass for accurate, level flight... the Automatic Approach Control to guide valuable cargo safely down the runway... the Gyrocompass and other flight instruments for accurate information on position and direction.

► These and other well-known Sperry products are designed for long

hours of trouble-free service... are designed to enable airlines to operate their cargo and passenger services more efficiently and more economically... with more profit. For example, the new Engine Analyzer checks engine performance during flight and prevents costly repairs on the ground.

► Meanwhile, Sperry research and engineering explore new, better ways for moving men and goods by air.

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AVIATION WEEK, May 30, 1949

NEWS SIDELIGHTS

More Secrets

How confidential and how secret can you get?

Acting as a policy of being as security-minded as possible, some qualifications for the USAF are subjecting themselves to needless stress and strain as their projects take on "classified" For example, in virtually every secret project, there are only certain departments which are in secret status, while other ordinary parts connected with the project need not be considered in the special "break-back" department. Similarly, plans with papers in confidential status need not feel obliged to turn away visitors. At long as the visitor stays away from the confidential projects and as long as they are not discussed with him, the information is free to admit him, subject to the National Command clearance.

Giddy enough some USAF security of force go to far as to treat this information itself as "not for publication" although personally every classification must have it to comply with security regulations.

Engine Switch

TransCanada Airlines will shortly touch off a major political row when it carries out its plan to switch from Pratt & Whitney engines to Pratt & Whitney A-2830 engines on its DC-6M transports built by Canadian. Canadian sources indicate the switch will be made shortly after the Canadian Parliament election on June 27. Present plans call for Douglas Aircraft Corp. to furnish complete power packs for the TGA DC-6M since it uses the same type as the American-built DC-6.

Naked Squeeze

Ticket agents on the West Coast apparently are getting transatlantic uncollared questions on the same kind of space that covered dangerous conditions on the New York/Puerto Rico run last year. Some agents ask tickets to passengers who are not told on what line there will be. When a not a table amount of business has been allowed, the agents control the various independent operators to see who will fly the group in the cheapest rate per head.

The agents may make up to 40 per cent commission on the deal, and the members may barely break even as a result. On the San Jose run, such tension drove the airlines that a year ago was there was a tendency to avoid on

James V. Forrestal

It was late in the war, about the spring of 1945, at a news conference to welcome to office a new Assistant Secretary of Navy for Air. The new official told about taking the oath of office aboard the aircraft carrier *Shiigo* in action off the Japanese Islands.

An inconspicuous man in the back of the room jumped up and said, "Mr. Secretary, it has not been announced that the *Shiigo* is his own action."

The small, beaming man, graying little man, stood in a chair, nearly straightened up and answered as he sat. "Well, why shouldn't it be announced?" he asked the assembly officer. "It has been in action since 47" he moved an important hand. "Go ahead and print it, that's not security," said Secretary of the Navy James Forrestal.

Last week, the man who led the greatest navy the world has ever seen and believed in giving the public the truth and a full deluge of death was dead—a victim of his own driving energy and not for perfection.

Former Secretary of the Navy and last Secretary of Defense James V. Forrestal, injured in his death from a wound of the Naval Hospital at Bethesda, Md., some out from the ranks of nine years' continuous service to the nation. Forrestal, who had been a "war casualty" for some time and who had been in and out of the hospital for some time, was still in the hospital when he died.

The staff of Forrestal's West house with the nation.

gains after which the engine was pushed to increase for operation. The higher temperatures of gasoline reduce its tendency to "pilot" in combustion before the start is made, whereas the comparatively heavy construction of kerosene "buys" on the combustion until the flame reaches its working in high level use and consequent flame dissipation.

The new ANF-28 fuel is actually a combination of gasoline, kerosene and a variety of other hydrocarbons but contains lighter elements that are vaporous. New fuel requires combustion chambers and fuel systems of different design. ANF-28 requires the alternate performance of jet engines about two per cent compared with regular motor kerosene. Air Force is willing to take the loss in return for reduced hot start damage.

USAF Too Busy

Some aviation industry leaders stood eyebrows last week when Air Section W. Street Birmingham and Gen. Hoyt Vandenberg, USAF Chief of Staff, sent their agents to the Aircraft Industries Association.

They were unable to attend the annual AIA board of government meeting at Williamsburg, Va., due to "press of other business." Their absence was interpreted by some as a slight to Admiral DeWitt C. Ramsey, new AIA president, because he was a Navy man.

Undersecretary of Defense and Vandenberg, told American Wings, the former had just returned to Washington from making a speech at Chicago. He the top-level members of American Airlines, Inc., and was "too busy" to attend the Williamsburg meeting. Vandenberg had to attend a meeting of the Joint Chiefs of Staff. Lower echelon USAF generals attended the Williamsburg long session.

Nevada Airlift

Airline figures prominently in the administration's \$44 million Nevada relocation program.

The vast Nevada relocation of dropships in New Mexico, Arizona and Utah—approximately 800,000 in West Virginia—does not lead itself to surface to highways. Interstate Department plans to force the construction of transportation system on air transport.

The contrast of duties and means which Interior Department plans to impact into the 6th and defense release reservation under the program will use an transportation-based conference.

Safeguarding Aircraft Electrical Systems



BURNDY
Aircraft Limiters



Photo shows how current limiter can be provided for the 150 volt AC limiters of Burndy type PL-100.

As a safeguard to flight, today's modern aircraft electrical systems are Burndy-Limiter protected. These vital aircraft "fuse" carry necessary currents for their primary under load circuits. They are particularly recommended for systems which use available conductors per phase leg, when limiter protected, a fault on a single wire is cleared without interruption of current in that leg of the circuit.

The close co-ordination of these highly accurate Limiters, and other thermal devices is little affected by the variation of ambient temperatures, thus they provide greater protection with the least weight and space.

Limiters and mountings are offered for 30-volt and 120-volt DC, and 120/200-volt, 400 cycle AC systems in various rugged storage Burndy Limiters meet the requirements of USAF Spec. Nos. 32552-A, 52596-B.

Complete engineering service is offered. For particulars, write for Bulletin 4791.

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AVIATION CALENDAR

- May 10—**Boeing** 4—ATA's latest instruction states that 7000, 20 C.
- May 12—**Boeing** 4—ATA's latest instruction states that 7000, 20 C.
- May 13—**Boeing** 4—ATA's latest instruction states that 7000, 20 C.
- May 14—**Boeing** 4—ATA's latest instruction states that 7000, 20 C.
- May 15—**Boeing** 4—ATA's latest instruction states that 7000, 20 C.
- May 16—**Boeing** 4—ATA's latest instruction states that 7000, 20 C.
- May 17—**Boeing** 4—ATA's latest instruction states that 7000, 20 C.
- May 18—**Boeing** 4—ATA's latest instruction states that 7000, 20 C.
- May 19—**Boeing** 4—ATA's latest instruction states that 7000, 20 C.
- May 20—**Boeing** 4—ATA's latest instruction states that 7000, 20 C.
- May 21—**Boeing** 4—ATA's latest instruction states that 7000, 20 C.
- May 22—**Boeing** 4—ATA's latest instruction states that 7000, 20 C.
- May 23—**Boeing** 4—ATA's latest instruction states that 7000, 20 C.
- May 24—**Boeing** 4—ATA's latest instruction states that 7000, 20 C.
- May 25—**Boeing** 4—ATA's latest instruction states that 7000, 20 C.
- May 26—**Boeing** 4—ATA's latest instruction states that 7000, 20 C.
- May 27—**Boeing** 4—ATA's latest instruction states that 7000, 20 C.
- May 28—**Boeing** 4—ATA's latest instruction states that 7000, 20 C.
- May 29—**Boeing** 4—ATA's latest instruction states that 7000, 20 C.
- May 30—**Boeing** 4—ATA's latest instruction states that 7000, 20 C.

PICTURE CREDITS

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- 2—**Boeing** 4—ATA's latest instruction states that 7000, 20 C.
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- 7—**Boeing** 4—ATA's latest instruction states that 7000, 20 C.
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- 9—**Boeing** 4—ATA's latest instruction states that 7000, 20 C.
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Torrington Needle Bearings provide compact, rugged design for Curtiss-Wright B-36 propellers



Seen in its position in the propeller mechanism of the Curtiss-Wright B-36 propeller and on the B-36, Torrington Needle Bearings are used in this mechanism because they provide exceptional compactness and load capacity.



These large needle gear shafts are mounted on Needle Bearings and bearings on L-14 relatively small. Shallow design, load capacity, these propellers the light weight and high speed operation of Needle Bearings plus their small size and high speed operation of 1200 rpm during blade feathering.



Rotating continuously at 1200 rpm, the drive gear assembly enters efficiently on high-capacity Needle Bearings. During pitch change, each bearing carries radial loads of nearly 600 pounds. The full complement of rollers provides a high factor of reliability and means long service life.



Reliability is no problem with Needle Bearings. Take the load, rotate smoothly in its position. The tip of the bearing is close to the shaft and helps prevent vibration. The Needle Thrust Bearing, for the left, is specially designed for the application to provide compactness and high thrust capacity.

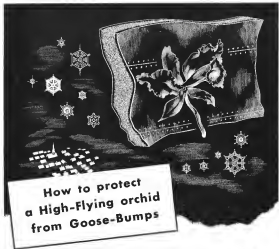
To keep your aircraft light for flight, rugged for safety and efficient for low maintenance and long service, use Torrington Needle Bearings. Let our engineers help you with any related design or installation problem. Write us today. The Torrington Company, Torrington, Conn., or South Bend 21, Ind. District offices in principal cities.



TORRINGTON NEEDLE BEARINGS

Needle • Spherical Roller • Tapered Roller

Straight Roller • Ball • Needle Rollers



How to protect a High-Flying orchid from Goose-Bumps

Fragile orchids on one flight, sharp-frozen lobsters the next... close control of cargo-space temperatures is mighty important to air-freight firms. And close control of temperatures calls for high-efficiency insulation in fuselage walls.

Fiberglass "Aerocor" insulation (FF-106, a form of Fiberglass "Aerocor") is high efficiency... $h = .684$ at $74^{\circ} F$. means... in light-weight... only 8.6 pounds per cubic foot. You get more insulating value per pound of weight with Fiberglass "Aerocor" insulation than with any comparable material.

And Fiberglass "Aerocor" insulation gives you other advantages... cannot settle or pack from vibration, won't feed flames or vermin, cannot absorb water within the glass strands to pick up dead weight. Is easy to cut and apply, even in tight spaces. Is not corrosive to aluminum.

Let us show you samples of the new Fiberglass "Aerocor" insulation, and give you data and specifications.

Write to Owens-Corning Fiberglas Corporation, Dept. 888, Toledo 1, Ohio. Sales Offices in 27 cities.

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**AEROCOR
INSULATION**

Fiberglass is the trade name (Reg. U. S. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with glass fibers.

NEWS DIGEST

DOMESTIC

Personal Aircraft reports for April by nine companies total 66 planes valued at \$243,883. Aircraft Industries, Inc. reports, compared with 45 and \$227,924 in 50a companies for March.

Cheney Award for 1946 went to First Lt. Carl S. Halverson, former Berlin shift pilot who originated Operation "Little Vittles." Presentation was by Gen. Hoyt S. Vandenberg.

Marshall Men, Navy flying boat, carried 101 passengers and cargo enroute in San Francisco-San Diego flight. First round was 249 passengers.

Southern Airways has bought three 27-passenger Douglas DC-4s from Central Airlines for service Memphis Jacksonville via Atlanta.

FINANCIAL

Bell Aircraft Corp. reports profit of \$59,668 for quarter ended Mar. 31. Sales and income totaled \$1,388,961, net \$237,391.

United Aircraft Corp. net for quarter ended Mar. 31 was \$1,206,435 after taxes. Shipments for the quarter amounted to \$14,818,223.

Electric Boat Co. annual report showed net earnings after taxes of \$2,072,079 for 1946, a figure \$1,371,214 over 1945. Net sales for 1946 were \$54,153,089, with aircraft and submarine production amounting to about \$33 million. Company is its strongest position it has ever attained, says President John H. Hopkins.

Kaiser Aircraft Corp. stockholders approval of increase of 410,000 shares of capital stock to total of 718,000 shares to carry out reorganization leading plan and increase production. Board of directors was authorized from seven to nine.

FOREIGN

Australia's Civil Aviation Dept. hereafter will provide and over all airport buildings, some of which are owned by commercial airlines. They will be leased to the operators. Airfields are all Commonwealth property.

Australia's 16 single domestic airlines carried 1,130,319 passengers last year, an increase of 323,176 or 32 percent over 1947. Route mileage was up 26 percent to 49,521. Load factor rose to 67.7 percent from 63.3 percent a year earlier.

INDUSTRY OBSERVER

►Miss special aerospace research planes will be built under the joint Air Force-Navy-NASA program that has already sponsored the X-1, X-2, X-3, X-4 and D-518 Mach 1 and M. North Sea for will be the X-5, to be built by Bell Aircraft Corp., and featuring a wing capable of varying its degree of sweepback. In flight Lockheed and Douglas will also probably join in the new research plane program.

►North Americans is trying to select the Air Force as an interceptor version of the F-86 series. The interceptor would have a new type nose and an intake that differs considerably from both the F-86 and the F-43 (formerly F-86C). An attempt will probably be made to develop a night fighter version of the F-86 using the Hughes lightweight engine rather than being used in the Lockheed F-94 night fighter.

►Gossamer's Dasher (F9H) experienced test hook trouble during its second carrier landing attempt recently, aboard the USS Franklin D. Roosevelt. McDonnell's Illustrious (F2H) also made its first carrier landings on the FDR about the same time as the Dasher.

►Douglas Aircraft is trying to interest the Air Force in its new turboprop powered A2D now under development as a carrier based attack plane for Navy. The A2D will be powered by an Allison T-40 turboprop and offers substantial improvements in speed and range over the AD series now in Navy carrier service.

►Curtis Propeller division is completing an addition to its Culver, N. J., plant for the construction of DeSoto type trainers for the Navy and Air Force. Navy order is for a jet fighter trainer.

►TWA is taking a look at the Barnard Landmaster transport built by Convair 144 at Muskogee. TWA engineers plan recently flew the Landmaster at Denver and made a company report on the project. The engine was estimated as a 53 passenger version of the Landmaster with a design cruising speed of 370 mph.

►Major modifications to British European Airways' Airspeed Ambassador turboprop slotted flap which will permit payload increase to 11,648 lb., increasing maximum seating capacity to 49 from 40. Takeoff distance maximum 32,000 ft., gross has been reduced from 5100 ft. to 4300 ft.

►The Wright T-35-1 turboprop engine utilizes a two-stage centrifugal compressor unit, the first of its design in the U. S. The T-35 develops 3200 hp at 7000 rpm and requires a 17-ft. wide blade propeller to absorb this great power. Although a major success, the T-35-W-3 is undergoing development. Air Force has abandoned the test for production. Wright is using a T-35 compressor unit as an air supply in its research laboratory for tests on turbine blades, compressors, etc.

►Air Force has dropped development of the Wright XJ-61-W-1, which utilized a multi-stage, axial-flow compressor, but not at the maximum speed of 3000 ft./sec. at 23,250 rpm. However, Air Force and Wright are continuing development of the T-35, a 9000 lb. and the T-37, an axial flow design of 12,000 lb. thrust.

►Armstrong Siddeley Motors of England has concluded a patent agreement with Westinghouse for use of the Armstrong Siddeley vaporizing combustion system for turboprops in American built airplanes. The system is designed to maintain combustion efficiency at extremely high altitudes, one of the major problems in current jet fighter performance at altitudes where the B-36 operates.

►De Havilland Doves, a trimotor biplane transport, has declined to pass initial certification tests by the Australian Department of Civil Aviation. Plans will make another attempt at certification with fixed pitch propellers replacing the manually-controlled variable pitch propellers originally used.

►TECMCO is making CAA approval of its 145 hp. Tandem triester, originally designed for military applications and export.

NACA Reveals Transonic Progress

Scientists disclose that, if war comes, supersonic air force could be started in few months.

Important aerodynamic research program in the transonic speed range was disclosed to aviation's top advisory engineers and executives at the 1949 annual symposium of the NACA held this year at Langley Aeronautical Laboratories.

Leading industry engineers commented it was the most practical display of aerodynamic research results ever assembled.

► **New Techniques**—New research techniques have developed a new area of study, tests the previous NACA in-flight inspection. At that time wind tests of the transonic range were still largely uncharted. New enough hands naturally have been established to get a clear definition of basic problems in research and to point the way to new solutions.

NACA revealed that it had been developing one type of transonic wind tunnel for several years. This tunnel approach, an early approach to eliminating the blind spot in conventional wind tunnel caused by the choking effect of shock waves between Mach 5 and Mach 1.5.

The early transonic tunnel was designed by John Stodt, NACA scientist and 1946 Collier Trophy winner, by mounting a two scale model on the rim of a five-foot five-inch diameter

The model rotating on a vertical plane allows more space within its hub to adjust the longitudinal velocity of the tunnel, various streamlines. Angle of attack of model is varied by changing speed of the wind tunnel stream. This is done by a single drive line located downstream from the model. This also does the work out of model's path. A pressure transducer is used to convert pressure from holes in the model to electronics in the tunnel control room.

The model used is extremely small and tests are conducted at low Reynolds numbers. Other techniques are now under study to permit transonic wind tunnel research on large scale models at high Reynolds numbers.

► **Transonic Industry**—Final study in research emphasis now directed into the transonic speed regime and into the new field of aerodynamics, which branch of dynamic loads on deflecting structures. It is now clear that the several major problems, formerly considered separate fields of special investigation, are undergoing combination into a single problem of several phases. As research moves into supercritical the difference between aerodynamic and structural problems is minimized. Soon may evolve a course of "aerodynamic-structural" combining all of the separate elements of

aerodynamic engineering.

Among research results revealed:

- **Model model research techniques** have proved extremely useful with the aerodynamic extended to dynamic problems.
- **A new flush air inlet for fuselage side installations** exhibits superiority over the divergent type.
- **A supersonic flow jet using a single instead of multiple shock compression** exhibits promise.
- **Swirl wing aircraft stability problem** can be solved through the use of the air intake flow separator.
- **NACA research aircraft** at Langley has been replaced by an impulse type which indicates even greater efficiency by reducing energy in the outer vortex regions.
- **Propellers** now have useful application to supersonic aircraft.

On the basis of presently available research information, practical supersonic aircraft can be designed and in the event of war the industry could begin production of a supersonic air force within a matter of months, according to Stodt.

U.S.-Canada Parley Negotiating Air Pact

The U. S. and Canada were preparing for advantage last week in negotiating a new bilateral agreement as commercial air rights, accelerated by the recent change in status of Newfoundland.

Official comment on the new pact was not expected before the close of the parley, which some of the negotiators hoped could be ended before the week was over. The U. S. State Dept. delegation to the conference, held in New York, was headed by CAB member Russell B. Adams. The Canadian group was led by Transport Minister Leslie Cheverly.

Main points at stake:

- **Right of U. S. lines to continue to use Gander** as a service and traffic stop on trans-Atlantic flights.
- **Third and fourth Canadian privileges for Canadian lines**—respectively, their right to bring Canadian passengers to the U. S. and carry U. S. passengers to Canada.

The first of three—the Gander privilege—was considered by most observers to be Canada's best trade in long-negotiated attempts to obtain the right to pick up passengers.

At Havana on Canadian routes to New Zealand and Australia and at Atlanta on routes to Japan and the Orient.

At Boston, Philadelphia or Baltimore as scheduled operations to Bermuda from Montreal and New York.

At Jacksonville or Miami on a route from eastern Canada to Nassau, the Bahamas.

AFL Tells ALPA: Hands Off Engineers

The month old Flight Engineers International Association (FEIA) was pointing its big gun in its first presidential indictment and lashed it. The executive council of the American Federation of Labor, or AFLA's complaint, ordered the old and powerful Air Line Pilots Association to stop organizing flight engineers.

Even before FEIA's first meeting in April, it had been granted an interim board charter by AFLA and jurisdiction over all licensed flight engineers. ALPA also holds an AFL charter, and some day ago began working against flight engineers on domestic routes (Aerospace Week, Aug. 9).

► **ALPA Moves In**—ALPA chartered the Air Carrier Flight Engineers Association (AFEA) and American Airlines flight engineers voted 31-4 in a National Mediation Board hearing that ALPA separate them. FEIA, during past sessions on flight engineers, protested to AFL.

Meeting at Cleveland, AFL's executive committee directed ALPA to:

- **Withdraw from the Mediation Board proceedings for representation of flight engineers of American Airlines and United Air Lines.**
- **Respect the jurisdiction held by the FEIA.**

At this in representation of flight engineers at all domestic airports. FEIA's strength now is chiefly among international carriers, TWA, AOA, PAA, although it was his Eastern flight engineers a "land grab" and raising objections to the status of flight engineers.

FEIA insists that ALPA's move into its territory was to make possible a system under which cockpit could shut back and forth between the right-hand seat and the flight engineer's station, depending upon the airline's personnel needs of the moment.

Under the AFL ruling, a flight engineer must meet with a pilot, a copilot with ALPA and eventually in one union, will confer on rights in the other to the members.

New and De Luxe

Pen Aeromarine Airways, rechartered by the Civil Aeronautics Board on limited trans-Atlantic routes (Aerospace Week, May 31), will raise the other way next week in its first instance.

The de luxe extra line New York-Los Angeles will fly via Toronto. Last June 13, with Boeing Stratocruisers will visit with foreign airlines for the last time in surprise air service. Pen Air calls it the "most de-luxe."

► **"The President"**—The traveler will pay \$100 more than the regular \$150 coach fare when he flies on "The President."

Ticket will include Sturgeon's (full seating seat). More de-luxe berths will cost from \$25 extra. A coast to coast four-berth station will be available at \$25 per berth.

PAA's most upper deck, among its engineers on the Stratocruiser, in its regular trans-Atlantic service starting June 2, calls for 51 seats, but the new interior on "President" planes will carry 70. Sixteen seats, in addition to 37 berths.

Stations are berth configurations.

The airline will offer a selection to casual, with over-crowded seats (as per the passenger's pleasure) by a light chair, and served on tables instead of trays by a staff of four stewards and a stewardess.

The flight will leave New York for London each Friday at 4 pm EDT and London for New York at 11 pm London time.

The new lower flight, says PAA, means no change in the carrier's third class, but no change to trans-Atlantic investment.

It has an eye on the 131,000 travel it says are expected to visit England during the 1949 tourist season.

Wright Production Changes Announced

Wright Aeronautical Corp. has made production changes at its Wood Ridge, N. J., plant that are expected to save approximately \$1 million a month.

Chiefly involved a discontinuance of "make-to-stock" engine which is not identified by the company but which may be the T-35 turboprop. This engine originally was scheduled for installation in Boeing's B-52 but discount was made some time ago. (Aerospace Week, May 14) that the Air Force had not ordered it into production.

Discontinuance of the turbine project eventually may involve the lay-off of about 450 employees.

Meanwhile, Wright is starting production of components for General Electric's J-47 jet engine which is assembled at the recently opened Lockheed plant.

While the production shift at Wright will not immediately make a reversal of the "trend of losses," Paul V. Shanks, new Curtiss-Wright chief and then engineer a low-price program aimed at establishing profitable operations. Wright Aeronautical holds shares in Curtiss-Wright's backlog of \$146 million.



B-50 DEVELOPMENT ON NEW TRACK

Boeing Airplane Co. has completed two tests on the first trucked landing gear experimentally installed on a B-50 bomber (Aerospace Week, May 24, 1949). The B-50 gear has double-truss beams in place of the one gear wheels. The gear is completely retractable in flight. The tractor gear allows a landing "bortop" are nearly three times greater than that of the wheel

gear. The main gear landing gear was dropped by a special test of the Boeing engineering division under Donald Phillips. The new gear took and land were built under contract by Fairchild Inc. & Republic Co. The tripod attached to the plane's main landing gear allows aircraft equipment to absorb substantially the action of the nose gear during high-speed taxi tests.



Britain's First Jet Bomber: the A.1

(McGraw-Hill World News)

LONDON—Britain's first jet bomber to fly—the English Electric A.1—has been ordered into quantity production. The newest medium range craft made its initial test flight earlier this month (Aerospace Week, May 25).

The A.1 was flown from English Electric's works at Preston, Lancashire, by Wing Commander K. F. Beaumont, the firm's chief test pilot.

► **Powered by Avro-Perkins** for the craft is provided by two Rolls-Royce Avon turbojets, most powerful British jet engines yet developed. Unofficially, it is understood the engine delivers around 5,700 hp thrust.

Configurations of the A.1 is conventional, with straight wing, tapered on

back leading and trailing edges, and a single five-and-a-half engine are mounted in the wing. Cockpit is placed well forward, actually in front of the wing.

Craft is expected to exceed 500 mph, but performance, weight and dimensions are still on the verge.

In his recent speech in the House of Commons, Arthur Henderson, Secretary of State for Air, revealed that the jet bomber was to go into quantity production, although he did not mention the English Electric Co. as the builder. Initial order for the development of the plane may have been placed about the beginning of 1945, according to sources. It represents progress together from the Air Ministry and Ministry of Supply.



SE 210

France Shows Its 94-Passenger Transport

Variety of airline and personal plane types displayed at Paris.

By Boyd Newell

(McGraw-Hill World News)
PARIS—Two hundred—the U. S. Boeing Stearman and Fokker's even larger SE 210 Arraguet—are the planes for transport at the 19th Paris Air Show. But they look nothing like the looking that the size for use in case a small aircraft had not been used.

The Stearman, belonging to Pan American Airways, is one of the few aircraft that is coming into use for transport. It is being used by the U. S. Army, Navy, and Marine Corps. It is also being used by the U. S. Navy and Marine Corps. It is also being used by the U. S. Navy and Marine Corps.

•**Boeing Stearman**—The Arraguet is the first big airline transport plane of international design produced in France since the war. While only the prototype has been built, the Fokker SE 210 is the first big airline transport plane of international design produced in France since the war.

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SE 210 in flight



SO 90



SO 90



Bouquet 152

Colors of the Arraguet is a mixed model and prototype. Front and rear portions of the colors are separated by a pattern and a bar.

•**Bouquet 152**—Bouquet has built to build and transport in its model 152, showing production in order to get the ship into production in case it is possible. Both the Air Ministry and Air France have high hopes that the 152 will prove well fitted for French colonial routes.

The craft has a span of 138.5 ft., length 44.2 ft., height 27.2 ft. It is powered by four Gnome-Rhone 14Rb five-cylinder engines, each rated at 1,000 hp. The 152 is rated at 10,000 ft. in 275 mph. With a payload of 44 metric tons (about 50,000 lb.) the craft can carry 301 passengers sitting, 25 standing.

•**SO 100**—The SO 100 is coming on the SO 100—the Bouquet-to make DC-3 in its Continental motor. The motor has reduced 25 of these light transports, and the Air Ministry has at least 40. Another batch has been ordered for export.

The Bouquet carries 37 passengers and is powered by two Pratt & Whitney R-2800 34-cylinder engines, developing 3,000 hp at 2,700 rpm at takeoff. Gross weight is 20,000 ft. in 275 mph. Span is 95.2 ft., length 62.1 ft., height 13.4 ft. Gross weight is 15 metric tons (about 33,000 lb.).

•**SO 95**—The SO 95, designed for short commercial legs, has a range of 500 miles and carries six or seven passengers. Gross weight is 12,000 ft. in 230 mph. Gross weight is 12,000 ft. in 230 mph. Gross weight is 12,000 ft. in 230 mph.

•**Bouquet 1025**—Bouquet's 1025 is a small, four-engine transport with a 23,000 lb. empty weight and a



Fokker C34 100



Bouquet 764

gross of 35,110 lb., including an 8,000 lb. payload. It carries a three-man crew. The Bouquet engine develops 530 hp at 3,300 rpm. Its takeoff.

•**Fokker C34 100**—The Fokker C34 100 is a four-engine version of a crop planer design and embodies a combination of metal and wood construction. The craft has a normal weight capacity of 10,000 lb. and weighs 15,544 lb. fully loaded. It has a 6,000 ft. flight with 12 passengers or a crew of two and a 1,000 ft. cargo load. Span is 87 ft., length 93 ft., height 19 ft.

•**Lightplanes**—The French launched a fleet of lightplanes at the Air Show, but

most showed prototypes that placed their weight on the wings for the average European.

•**Nieuport-Delage**—The Nieuport-Delage, perhaps the best known and best of the postwar lightplanes, will be 5,000. The craft is a four-seater with retractable landing gear, and carries at 135 mph. About 250 have been sold.

•**SO 100**—The SO 100, as the 77 hp class, will be 5,000. About 200 have been ordered for use class. The first-class Cessna sells at about \$11,680.

•**SO 100**—The SO 100, as the 77 hp class, will be 5,000. About 200 have been ordered for use class. The first-class Cessna sells at about \$11,680.



Aerial view of the Grand Public, showing lightplanes



Above and below, two views of the SO 7060



powered by a Walter 105 hp engine, and is of all-metal construction.

The plane, whose production plans are limited, will be about 1600 lb.

While the French exhibit was by far the most extensive of any country represented, the Grand Public, and the opening Eglise des Inventiones, put across the view, also contained impor-

tant exhibits of Italian and Czech aircraft.

Other Countries—In the Italian display, Merlo presented a cross-section of its long-range E2 185, designed for trans-Atlantic service. Merlo exhibited its MD 105 touring plane, which is made of both a metal and plywood fuselage. Put displayed its G59 trainer,

Praga, its two engine amphibious, Aerobus, its four seater S1801 Gato touring plane.

The Czechs, in a lightplane fly-in, exhibited the four place twin engine Aero 45, the Domo N1, and the two-place Short M2 and Zim Z1. Fokker, the Dutch aircraft manufacturer, exhibited the S 11 and S 12 trainers.

The U. S. exhibits had no planes in the 1946 Air Show, but, in addition to the Stinsons, three versions of the Lockheed Shooting Star, a Convair-Lear, a Beech Bonanza and Mothair biplane, and several Douglas models. British "Vanguards—Britain's first construction was the Vampire which recently flew from Paris to Caracas at 45 mph. An impressive battery of British biplanes was also on display—three strong Spitfires, a Pylons, Mustang and Double Mustang, and the Bristol Peacon.

Belgium, which usually is represented at the Aeronautical Salon, was absent, Switzerland and Turkey, both of which were not invited to the exhibit, had aircraft on display this year. Sweden, which has been making known extensive export plans, failed to exhibit.

The Show was international in nature (official title: 1946 International Aero meeting) but the bulk of displays belonged to France. The fact that few people were disappointed in the Salon may be considered as small tribute to France's efforts to re-evaluate and to affirm its aircraft manufacturing power.

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is the fact that no special wrenches are required—any socket wrench will do.

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AVIATION WEEK, May 20, 1946

19

AIR RESCUE

Over January jungles, forests and mountains, helicopters of the USAF Air Rescue Service have flown in search of stranded airmen and prisoners. The helicopters got there because they have been given a "mother" ship—the Funchell Packet—that transports them over distances far beyond their range. Thus, our Air Force has added a new ability to the versatile Funchell Packet—increasing the importance of its part in the development of modern airborne infantry tactics.



History of Money.—Yet Spain produced lead a half a century before the American west had a Fairchild Pocket.

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FINANCIAL

Cargo Lines Look to Financing

Certificated freight lines, encouraged by recent CAB decision, may present new field in public securities.

A new chapter in public financing may soon be written as the recently certified state laws attempt to save

Indeed, the Civil Accounting Board majority decision is designed to help GAAP's ¹⁰ and the

While certificate dantam is only five years, there, however, soil, space, and

likely be advanced in intangible assets of questionable value in any public sale.

■ **James Duane**—CAD member Harold Jones, vigorously denouncing, implied that the assets to the large carbon steel plant were sold for less than their book value. This statement highlighted the importance attached to the steel's certificate of authenticity.

Jones declared, "In reliance on this covenant, the railroad, the investing public and government and private lending banks have been deceived."

Under Vee's Alloy, Neil & Co. spokeswoman, Eugene Ames last August said that the company's stock was trading at \$15, 1995, at \$3 per share. They share \$150 million there is a only about 10¢.

All this was said without any explanation of the company's financial condition.

The carrier's operations, considered a mounting deficit, substantially can be explained by the company's financial condition for its stock. The Vee Alloy firm is now being sold by a number of stockholders for approximately

lapsed or forfeited its contract of \$330 million. This production was the second contained in the Civil Aeronautics Act and the integrity of the quasi-judicial agency set up by Congress. The second amendment to the Act was to ensure security and stability. The provisions relating to the insurance of certificates of public convenience and necessity were believed to give as the

Despite the fundamental litigation involved, the cargo line appears to be in a position to launch a new ship—once CAIL's tentative decisions authorizing their operations is made final. This is expected to take to permit the all-cargo carrier to launch full-scale operations by June 30.

World War II led, as the state often expected economic opportunistic popularity. An aggressive underwriter who placed "oil" in the name of a new-born enterprise found little difficulty in selling shares to a gullible public. Only a few ventures survived, the others collapsed after brief flourish.

Financial resources had been exhausted.

At the time of the upfront cash offering, Andre de St. Paul and Co. New York agreed to undertake purchase of an additional \$95,000 shares for interest financing. This never was done but the record shows that public financing would be undertaken in the event of certification. California-Pacific stock is quoted currently around 11 cents a share.

► **Certified Cargo Lines**—The three major all-cargo lines certified by the Board have all done some form of public financing and managed to do considerably better than most of their competitors who fell by the wayside. Nevertheless, no investor in any of these lines carries on least of one profit.

• **Slick Assets, Inc.**, among the most visible public, has the closest financial record of the survivors. Last report shows about 176,000 shares of \$50 par value common stock outstanding owned almost entirely by the Slick Associates. There also are more than \$1,400,000 in 4 percent convertible income debentures owned by private common investors. These debentures are now interest bearing until Mar. 1, 1990 and convertible into common stock up to that date only.

• The Flying Tiger Line started domestic cargo service as National Skyway Freight Corp. in July, 1945. In April 1946, 500,000 shares of new common stock were marketed at \$5 per share to the public, net proceeds to the company being \$4.75. A total of 726,090 shares currently is outstanding, with a market quotation of around \$1.50 per share.

• **U.S. Airlines, Inc.**, began domestic services in December, 1945. In June 1946, company sold 900,000 shares of new stock at \$3.25 per share, reducing \$3.25 per share after underwriting commissions. There now are 1,000,000 shares outstanding with a current market quotation of 39 cents per share. There also are 100,000 stock purchase warrants outstanding convertible at \$3.25 per share, originally issued to the underwriter and company officers.

Largely due to the poisoning nature of their activities, none of these three carriers can expect a net profit from its cargo operations. Accordingly, any refinancing that may be attempted must be predicated upon future prospects. This promises to invite a searching appraisal from any sophisticated investor in light of the past disastrous record.

There will be these always, new chafers, who will point to the initial failure of the governments of the presently certificated passenger airlines and their past successful financing operations. It is this sort of atmosphere which will frustrate any subsequent security flotations of the newly-certificated airlines.

—Selle Albeck

KEEP AHEAD WITH GENERAL ELECTRIC AIRCRAFT INSTRUMENTS



Extravagant Everson:

His company buys only "system-built" piston indicators. Sure, it's a few cases of a necessary to have indicators specially designed and constructed. What Everson doesn't realize is how much time and money they could save by using G-E standardized indicators for all normal requirements. But . . .

Progressive Peterson:

He hasn't specified the new G-E standardized (except for special dial design) indicators . . . for almost 48 jobs: wheels, flaps, trim tabs, etc. The local G-E engineer has explained how these instruments help him reduce initial, stocking, and maintenance costs; get early delivery and meet government specifications. They also make model identification simpler. In addition, G-E standardized piston indicators are now being harmonized needed to increase their life and to prevent possible malfunctions because of dimensional environment conditions.

PLAN NOW, TOMORROW'S INSTRUMENTS ARE BEING DEVELOPED TODAY!

New designs are good. But, General Electric is constantly striving to make them better. Many new types are in development at present. The savings in life, weight, and maintenance costs, and the increased accuracy and reliability can be yours if you plan now. Let us fit your particular requirements.



GENERAL ELECTRIC

PRODUCTION

"Get-Ready" Cost: \$20 Million

USAF will spend biggest part; \$13 million will go for Phase III contract high production studies.

By Robert Hott

Approximately \$20 million will be spent during fiscal 1950 on industrial production of the American aircraft industry.

USAF will spend the lion's share with \$15 million earmarked in its fiscal 1950 budget for that purpose. This is a measure of personal pay and travel costs.

The Navy has approximately \$4 million for similar activity an average.

Contract Phase III contract for the industry will be some \$15 million to be spent for Phase III contracts with individual manufacturers for high volume production studies to be made of these products.

USAF will spend about \$11.6 million on Phase III contracts with \$1.4 million for the Navy.

USAF will also its next batch of Phase III contracts of aircraft engine and components manufacturers in an effort to alleviate partially anticipated shortages in these fields. USAF contacted for its high volume production studies on aircraft with funds appropriated in 1947 and 1948. These contracts called for production studies on the following airplanes:

- Beech-C-45, T-7, T-11
- Bell-48-12A, B-15
- Boeing-B-50, B-54
- Cessna-B-16
- Fairchild-C-82, C-119, T-10
- Lockheed-F-80
- North American-T-6, F-56, F-51, C-52, B-41
- Republic-F-84

Navy has completed studies for USAF on the Grumman SA-16 as a piston engine plane.

Longest one of the fiscal 1950 USAF Phase III contracts will go to engine manufacturers. These contracts will go to:

- General Electric (and its subcontractors)—\$12,000 for high volume production studies to be made on the J-47 turbojet.

This engine is used in production versions of the B-47 and B-54 bombers; the F-86 fighter and a nuclear power on the B-36 bomber.

Alfred Brown of General Motors, \$1,500,000 for similar studies on the J-47 turbojet for turbojet and the

J-47 and J-48 turbojet. The J-48 is used on the B-36, B-54 and F-86. The J-55 powers the F-84 fighter.

Pratt & Whitney—\$800,000 for production studies on the J-48 turbojet and \$1,000,000 for studies on the J-55 (Wasp Major) piston engine. The J-48 is a Pratt & Whitney version of the British Rolls Royce T-ay turbojet and will power several of the new USAF fighters.

Wing Major currently powers most of the USAF heavy transports and the B-36 bomber.

Total of \$15,000 will be used for production studies of other engines to be used on USAF planes.

In addition Phase III contract funds will be allocated for the following studies:

- Dagupan—\$1,216,000
- Fire Control System—\$2,225,000
- Reading System—\$765,000
- Radio Night—\$332,700
- Radio and Radar—\$428,750
- Leading Com—\$415,500
- Turbo-Superchargers—\$178,900

Balance of the Navy allocation will be spent for similar studies, \$10,000, nuclear tests and production equipment, \$1,140,000, plant and tooling studies, \$354,000, and industrial research studies, \$544,000.



BANSHEE'S "WALS" GET PRE-INSTALLATION CHECK

This portable test stand for checking jet engines prior to installation in airframe of F2H Banshee was constructed by McDonnell Aircraft Corp. Engineers to speed production vehicles. Use of device can save time and money in checking plane for flight, checks necessity of flying up each whole tests are conducted. Sheet

Test Equipment—\$114,500
Auto-Pilot—\$117,500
Instruments—\$114,750
Ground Handling Equipment—\$65,500

Other USAF industrial installation allocations include \$415,000 to cover engine component contracts, \$750,000 for engine component tests at airports, nuclear tests, etc., \$150,000 for purchase of base studies on availability of industry, planning factors, etc., \$45,000 for protection of industry in various, \$460,000 for purchase of engineering and industrial services as studies of new industrial techniques, analysis of planning data and development of new manufacturing equipment, \$1,621,000 for maintenance of stand by plants, \$1,721,000 for acquisition of more machinery and equipment.

Navy Studies—Navy spent \$3,002,500 out of fiscal 1949 funds for a high level of production study. The Lockheed F2V patrol bomber used and \$1,751,600 for a similar study on the Westinghouse J-48 turbojet engine issues. In fiscal 1950, Navy plans to spend \$1,456,000 for Phase III contracts on a new airplane (probably the McDonnell B-36) and the Grumman Panther) and another turbojet engine (probably the Westinghouse J-48).

Balance of the Navy allocation will be spent for similar studies, \$10,000, nuclear tests and production equipment, \$1,140,000, plant and tooling studies, \$354,000, and industrial research studies, \$544,000.



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test, N78-18175 Amendment No. 2 to
test of General Electric Co. N78-18281
N78-18281, N78-19625, N78-19757
N78-18089, N78-12176, N78-178
N78-11499, N78-17351, N78-14311
N78-19466, N78-17549, N78-15318
Order 15167899-1798, Order 1516805
167, Order 15168499-1185, Order 1516
9-446, Order 15169399-3075, N78-05
231-49

General Motors Corp., Indianapolis, In 46201-1949, Augustin Ave. N. 2, NDC 18194, Order 175-255-49281

Allison Valve Division: NDC 6007, Armstrong St. 4, W-111-415 or 22128

Armstrong Division: NDC 6075, NDC 10265, W-111-415 or 22128

Rockwell Products Division: NDC 60211, NDC 12-1218, NDC 65-12485

Harsco Radio Division: NDC 11401

Pocket Electric Division: Order 153-00-49751

AC Spark Plug Division: Order 153-00-45-1000, Order 151-13140-694, W-111-415 or 22128

General Tire & Rubber Co., Akron, Ohio. ABO Order Number—40923, AEO Order Number—305133, Order (5) 01-4276, Order (10) 00-44-1551, Order (5) 0132-6871.

Glenco, G. M. & Co., Inc., Pasadena, Calif. 707-833 or 2143.

Griffin Tire, Inc., Los Angeles, Calif. AF (13) 003-124.

Gul Electric Manufacturing Corp., R. Larch, Calif. Nite 3167, Nite 3168.

Glushko Fastener Corp., Glendale, Calif. N018-9421.

Gulf Corp., Chicago, Ill. N018-1300.

E. E. Calkins Co., Meno, Ohio N133
8607, N133-91106, N133-9052, N133-
9112, N133-8666, N133-11847, N133-
11150, N133-8144, N133-9099, ASO
Under Number-18929, ASO Order Num-
ber-18924, ASO Order Number-18914
ASO Order Number-18914-5, ASO Order
Number-18914-4, Order (1330100)
Under 113 090-95-378, Dallas (1330804)
1373, Order (1330804) 446, W16486
21285, W15455-5, at 22352, W13-815
21294

Goodhue Arentz Co., Alton, Ohio
N133-12336, Letter of Intent, N133-
8609, N133-36646, W13-815, at 21352

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General Engineering Co., Detroit, Mich.
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Green Machine Co., Inc., Madison
Conn. 06454-1007.

General Manufacturing Co., Utica
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Amendment No. 9, NDA(s) 3440 Amend-
ment No. 28, NDA(s) 3440 Amendment
No. 18 NDA(s) 3440 Amendment No. 3
NDA(s) 3451, NDA(s) 4146, NDA(s) 427
NDA(s) 3449 Amendment No. 17, NDA(s)
3451, NDA(s) 3455 Amendment No.
NDA(s) 3461, NDA(s) 3465, Amendment

No. 1 in leader of talent, N1818-303
 N1818-771, N1818-994, N1818-994
 N1818-995, N1818-1000, N1818-1010
 N1818-1000, N1818-1119, N1818-1819
Julius Manufacturing Co., Inc.
 Cal. N1818-995, N1818-999
Short Frothing & Co., Inc., Frothing
 N. Y. W1916-8 or 2166
Herman Electrical Manufacturing Co.
 Mansfield, Ohio N2419-1982 Associates
 No. 3 Order (51-81499-14), Order (51-
 659-9-22) N2419-999
Hornell Industries, Inc., Papa, Ohio
 Order (51-815-48-852, Order (51-815-48-
 196)

Neko Corp., Long Island, New York
 N.Y. 11565-9550
 Henry, Ford Co., Oiler, 4780048, 5011
 Hetherington, Robert & Son, Inc.
 Kansas 164, P.O. 11565-2445
 Illinois Electric Instrument Co., Clevel-
 land, Ohio 11565-5555
 Inland Steel Corp., Buffalo, N.Y.
 11565-1013
 Inyo Air, Inc., Redwood, Calif. 91565-
 5752, 11565-0750, 11565-5412, 11565-
 1013, 11565-1067, 11565-1197
 Inco-Penn, Inc., New York, N.Y.
 11565-0300 or 21565
 Iron Coal Handling Co., Belleville, Mo.

Imperial Resin Manufacturing Co., Chicago, IL 809/3034
Independent Acrylic & Coarse Prod. Co., NY 516/350-446
Indiana Steel Products Co., Chicago, IL 800/6-10-10
Industrial Contractors, Inc., Trenton, N.J. 908/31148
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Kraft Foods Tool Co., Inc., Hartford
Conn. N101030306, N101030401, N101030402, N10103120906, N1010310005, N1010310007

Krupp Instrument Co., Inc., New York
N.Y. N1010310046, N10103110010, N1010311005

Kuhn, Walter & Co., Inc., Baltimore
Md. N1010310210, N10103100156, N1010310038, N1010310039, N1010310040, N1010310066, N1010310067, N10103110018, N10103110019, N10103110020, N10103110021, N10103110022, N10103110023, N10103110024, N10103110025, N10103110026, N10103110027, N10103110028, N10103110029, N10103110030, N10103110031, N10103110032, N10103110033, N10103110034, N10103110035, N10103110036, N10103110037, N10103110038, N10103110039, N10103110040, N10103110041, N10103110042, N10103110043, N10103110044, N10103110045, N10103110046, N10103110047, N10103110048, N10103110049, N10103110050, N10103110051, N10103110052, N10103110053, N10103110054, N10103110055, N10103110056, N10103110057, N10103110058, N10103110059, N10103110060, N10103110061, N10103110062, N10103110063, N10103110064, N10103110065, N10103110066, N10103110067, N10103110068, N10103110069, N10103110070, N10103110071, N10103110072, N10103110073, N10103110074, N10103110075, N10103110076, N10103110077, N10103110078, N10103110079, N10103110080, N10103110081, N10103110082, N10103110083, N10103110084, N10103110085, N10103110086, N10103110087, N10103110088, N10103110089, N10103110090, N10103110091, N10103110092, N10103110093, N10103110094, N10103110095, N10103110096, N10103110097, N10103110098, N10103110099, N10103110100, N10103110101, N10103110102, N10103110103, N10103110104, N10103110105, N10103110106, N10103110107, N10103110108, N10103110109, N10103110110, N10103110111, N10103110112, N10103110113, N10103110114, N10103110115, N10103110116, N10103110117, N10103110118, N10103110119, N10103110120, N10103110121, N10103110122, N10103110123, N10103110124, N10103110125, N10103110126, N10103110127, N10103110128, N10103110129, N10103110130, N10103110131, N10103110132, N10103110133, N10103110134, N10103110135, N10103110136, N10103110137, N10103110138, N10103110139, N10103110140, N10103110141, N10103110142, N10103110143, N10103110144, N10103110145, N10103110146, N10103110147, N10103110148, N10103110149, N10103110150, N10103110151, N10103110152, N10103110153, N10103110154, N10103110155, N10103110156, N10103110157, N10103110158, N10103110159, N10103110160, N10103110161, N10103110162, N10103110163, N10103110164, N10103110165, N10103110166, N10103110167, N10103110168, N10103110169, N10103110170, N10103110171, N10103110172, N10103110173, N10103110174, N10103110175, N10103110176, N10103110177, N10103110178, N10103110179, N10103110180, N10103110181, N10103110182, N10103110183, N10103110184, N10103110185, N10103110186, N10103110187, N10103110188, N10103110189, N10103110190, N10103110191, N10103110192, N10103110193, N10103110194, N10103110195, N10103110196, N10103110197, N10103110198, N10103110199, N10103110200, N10103110201, N10103110202, N10103110203, N10103110204, N10103110205, N10103110206, N10103110207, N10103110208, N10103110209, N10103110210, N10103110211, N10103110212, N10103110213, N10103110214, N10103110215, N10103110216, N10103110217, N10103110218, N10103110219, N10103110220, N10103110221, N10103110222, N10103110223, N10103110224, N10103110225, N10103110226, N10103110227, N10103110228, N10103110229, N10103110230, N10103110231, N10103110232, N10103110233, N10103110234, N10103110235, N10103110236, N10103110237, N10103110238, N10103110239, N10103110240, N10103110241, N10103110242, N10103110243, N10103110244, N10103110245, N10103110246, N10103110247, N10103110248, N10103110249, N10103110250, N10103110251, N10103110252, N10103110253, N10103110254, N10103110255, N10103110256, N10103110257, N10103110258, N10103110259, N10103110260, N10103110261, N10103110262, N10103110263, N10103110264, N10103110265, N10103110266, N10103110267, N10103110268, N10103110269, N10103110270, N10103110271, N10103110272, N10103110273, N10103110274, N10103110275, N10103110276, N10103110277, N10103110278, N10103110279, N10103110280, N10103110281, N10103110282, N10103110283, N10103110284, N10103110285, N10103110286, N10103110287, N10103110288, N10103110289, N10103110290, N10103110291, N10103110292, N10103110293, N10103110294, N10103110295, N10103110296, N10103110297, N10103110298, N10103110299, N10103110300, N10103110301, N10103110302, N10103110303, N10103110304, N10103110305, N10103110306, N10103110307, N10103110308, N10103110309, N10103110310, N10103110311, N10

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News Engineering Co., Niswacker
 Office: M0402 5710 N1035-0990, N1035-
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Albion-Downer Paint Glass Co., Toledo
 Order (31 816-09 507

Leaside Industries, Inc., Mission, Va.
 Tel: 7150 N1035-10876.

Link Aviation, Inc., Fitchburg N. Y.
 Tel: 51014, N1035-12347, N1035-0100

Link & Co., Inc., New York, N. Y.
 Dtd 10178

Lynghorners Corp., Long Island, N. Y.
 9135-0122, N1035-0990, N1035-1945

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Leaf Manufacturing Co., Inc. P.O.
113-56478, Cedar Rapids, IA 52402-0478

WHAT'S DOING

ON the opposite page are two significant dates in aircraft engine history. On the first, May 14, 1947, Pratt & Whitney Aircraft acquired an option to build its own version of the Rolls-Royce Nene jet engine.

The second, November 30, 1948, marks the date on which Pratt & Whitney delivered to the Navy the first production model of that engine—the JT-6 "Turbo-Wasp". It was installed in an F9F Grumman Panther.

In between those dates, there were 566 days. And nearly every one was a red-letter day in some department of Pratt & Whitney Aircraft. For, each one marked one more step in the completion of a task that may sound easy but actually took 18 months of the hardest kind of work by our organization.

Externally, the Turbo-Wasp looks pretty much like the original Nene engine. But there the resemblance ends. The redesign of many parts, the development of improved manufacturing processes to speed quantity production and, in some cases, the substitution of new materials represent only some of the problems encountered. All told, more than a million man-hours were spent in readying the Turbo-Wasp for production. That's equivalent to the full time of one man working a 40-hour week for 500 years!

Now, to all of this must be added the tooling-up that had to be done, shop rearrangement, actual production of the engine, testing and a host of other tasks requiring additional hundreds of thousands of man-hours—all accomplished within those 566 days. The opposite page will give you some of the highlights of this achievement.

The production of the Turbo-Wasp engine represents only one phase of Pratt & Whitney's continually expanding development program. Simultaneously, we are working on the even more difficult task of designing and developing from scratch, entirely new types of jet power plants. At the same time, we are continuing the refinement and development of the well-known Wasp line of reciprocating engines.

It keeps us pretty busy.



PRATT & WHITNEY AIRCRAFT
EAST HARTFORD, CONNECTICUT

ONE OF THE FOUR DIVISIONS OF UNITED AIRCRAFT CORPORATION

at Pratt & Whitney Aircraft?

1,100 DRAWINGS

We executed more than 1,100 different drawings of the original Nene engine. Every one of them had to be redrawn to conform to American design practices.

1,000 DESIGN CHANGES

The original engine had to be adapted to use American-built components, as well as to provide for the use of new materials or new processes suitable for quantity production. We made more than 1,000 design changes to accomplish these objectives.

5,300 SPECIAL TOOLS

It takes all kinds of tools from a simple hand drill to a 40-ton hydraulic press to build an airplane engine. For the Turbo-Wasp we had to design 5,300 special tools. Counting drafts, we made nearly 10,000 tool designs before we were ready to put the engine into production.

9,000 OPERATIONS SHEETS

Each step in the processing of each part of an engine has to be outlined in detail to give the shop all the information required to do the job. On the Turbo-Wasp our production engineers had to write up more than 9,000 operations sheets. Many of these required the handling of new materials or the use of new processes previously unknown to us.

225,000 SQ. FT. OF FLOOR SPACE

In order to build the engine, we had to have a place to do the work. We managed 225,000 sq. ft. of floor space (equivalent to 4 football fields) for manufacturing this one type of engine. This involved careful planning of production lines, and the installation of moving air, thousands of hand tools, benches and other items of factory equipment as well as 250 machines.

35,000 MANUFACTURING OPERATIONS

There are 1,200 different kinds of parts in a Turbo-Wasp—7,000 pieces in all. Each goes through many operations before it is ready for assembly into the finished engine. About half the parts are built here, the rest by a specially trained team of 250 subcontractors. Approximately 35,000 manufacturing operations are done by us or our own plant or outside parts for our Turbo-Wasp. To this can be added the runs of thousands performed by our subcontractors.

1,700 HOURS OF TESTING

After a complete Turbo-Wasp was built, it had to go on a test stand and put a rigorous 1,700-hour test. And that's only part of the story. Many subassemblies of the engine were tested for hours on end to make sure they would stand up in service. By the time the first engine was shipped, more than 1,700 hours had been spent on complete engine testing, in excess of thousands of hours of component testing.

10,000,000 DOLLARS

To see the story Pratt & Whitney Aircraft acquired to design and build the Turbo-Wasp engine and the line production model was delivered last November, we spent more than 10 million dollars on it. That's the sign of more than 17 thousand dollars a day. They don't make money with actual millions invested in new research and new facilities devoted to all types of jet engines.





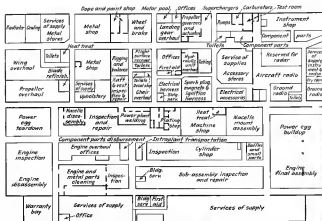
EXTENSIVE AREA of FAA components involved: section, unannounced (1) engine test, (2) engine overhaul, (3) accessory overhaul, (4) start components, fuel and control tuning, and chemical lab. (5), (6) warehouses, and (7) aircraft file storage and air freight.



BRUCE NORDDOCK is being credited for past Statehouse. Structures will have electrical, drainage facilities "opened" as



SEVEN-ACRE postoplatereconditioning building, shows in part, house protection from the corner of DC-4, DC-5, Corvus Lane, Constellation and the Statuaries.



WIDE RANGE of activities is featured in three levels showing characters in action: top (strong) and powerful overall (bottom).

Maintenance Goes on the Production Line

Proven techniques applied on large scale at PanAm's giant Miami overhaul base for aircraft, components.

By Irving Stone

Freeman manufactures backhoes at 90% efficiency—a pretty large-scale production line treatment at Pan American Airways' Miami overhead bag

In what is probably the world's largest refuse incinerator facility, a closely controlled, semi-production environment plan has been instituted to cope with cost-consuming aspects of growing demand complexity, diversity of replacement, and for future conversions.

- Overhead Cost—Fixed objective

of the activity is to reduce maintenance cost of aircraft per flight hour through reorganization of equipment and overhead facilities for a high volume of work. This eliminates duplication of similar setups at PAA's Atlantic and Latin American divisions and makes for most efficient full-time use of tools. The Pacific division is not yet involved in the plan because of the ferrying time involved.

Activated in May, 1948, and beginning full operations last September, the base is now servicing almost 300 craft

—5 DC-6s, 18 Constellation, 20 ConvairLiners, and 50 DC-8s. And 11 Stratocruisers are scheduled for delivery, the first expected in August.

Primarily, at least one Constellation and two DC-4s are ferried each week to Miami from the Atlantic division base at La Guardia. The Constels are brought in for engine change and overhaul every 1000 hr. DC-4s get heavy service (250 hr. and above) and overhaul.

Craft from the Latin American division are brought in on regular open-market schedule.

Facilities at the base could accommodate work for other operators, but no maintenance arrangements with other



LINE: LINE keeps Constellation's R & Ds flowing through power-up buildup. Next step is engine test for final proving of package.

Aeroelasticity: A New Science

Once separate studies of aerodynamics and structure design combined in work on high-speed aircraft.

By Robert McLaren

The growing complexity of high-speed aircraft design rapidly is generating an entirely new science: aeroelasticity.

Already this new science promises an eventual revolution in aeromedical engineering because it combines the once separate studies of aerodynamics and structural design into a single field. The subject is as new, and probably so large that even its boundaries are not yet clearly defined.

What is certain, though, is that the field encompasses the major problems of transonic and supersonic speed. Attainment of these speeds, more than any other factor, has made necessary this new field of technical effort.

What is fundamentally, simply, both of airplanes in motion and the interplay between external and internal forces created by that motion. The subject involves the interrelationship between aerodynamic (inertial, drag, elastic structural design) and aeroelastic forces acting on an airplane in flight.

Historically, the aircraft structure has been treated as a rigid body, and dynamic forces have been treated as static forces by assuming a stationary condition of equilibrium and introducing the proper inertia forces in accordance with d'Alembert's principle. With this simplification at the pocket, an aircraft could be treated as a set of almost independent functions in the process of aircraft design.

This same assumption that the structure is a rigid body is made in the aerodynamic design of a plane. And the determination of the external shape also proceeds independently. The quantitative effect of structural deformations in flight upon the aerodynamic characteristics of the airplane is ignored. This procedure greatly simplified the overall problem of aircraft design. The three areas involved that he was simply a problem of statics. The aerodynamic, structural, and even was a problem of incompressible flow.

Conditions Change—This method was all right in the past. Even military and racing aircraft had comparatively few structural stresses. Structural deformations were of comparatively small magnitude and of little aerodynamic consequence at low speeds. And the elastic structural treatment required to solve combined aerodynamic-structural problems is extremely complex.

But times have changed. During the war aircraft speeds moved up past 500

mph. It is no longer so safe to assume that design consisted of separate parts: form of structure and flow. So, the science of aeroelasticity was born.

Three-in-One—Because it combines the three basic aerodynamic sciences: aerodynamics, structures and stability, and control, aeroelasticity embraces all of the old design problems heretofore classified as "miscellaneous." They include vibrations, control, buffeting, gust response, control reversal, gust loading and impact loads.

These phenomena have been handled in the past by analyzing individual or parts through wind tunnel and flight tests and computing, or estimating, the difficulties through the use of individual design changes. This is an expensive and time-taking method of "developing" which aeroelasticity attempts to subsume into general equations useful for design purposes.

Contributing to the complexity of the new science is the frequent condition of two or more of these separate effects into a single difficulty. For example, no mathematical method can attribute control difficulties to high-speed flight individually to compressibility or to distortion.

It is when the field is so available is the use of flight tests at low and high altitudes, since compressibility effects are manifest at a given Mach number whereas distortion effects are manifest at a given dynamic pressure.

The nature of the science of aeroelasticity can be appreciated by this review of some of the phenomena being studied.

FLUTTER

One of the oldest and persistent aeroelastic problems is flutter, first studied in 1916. It is a rapid oscillation of an airplane surface created by an initial disturbance, and sustained by a couple between the external inflow and the internal elastic forces of the structure. It can quickly build up to amplitudes until structural failure occurs. While there is a wide variety of flutter phenomena,

release, transonic and supersonic flutter are distinct and require individual treatment.

Subsonic Wing Flutter—Flutter begins when a wing bends under air load, the bend increasing towards the tip. The bend changes the angle of attack of a given chord plane and, therefore, the lift along that wing. Simultaneously, the change in lift also causes bending loads causing the wing to bend. The air increases towards the tip.

The motion has both flexural and torsional components. If the wing structure is sufficiently stiff to constrain either of these components, flutter does not occur. As the wing bends it reduces the angle of attack of the airfoil, the induced lift is reduced and therefore the tension of the section is reduced.

This reduction in the bend puts the design angle of incidence outside the bend in the opposite direction and the tension is required to force a cyclostatic cycle. The torsional displacement lags behind the flexural displacement and it is this phase difference that determines the ability of a wing to damp an oscillatory tendency. This phase difference can be controlled through the proper location of the wing elastic and gravity axes.

The simplified description is applicable only to flutter in two degrees of freedom. There is flutter in a single degree of freedom (the stall) and flutter is as many as six degrees of freedom.

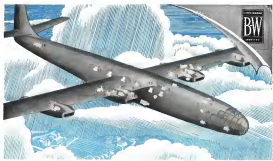
When the damping system is small the oscillations are damped out and no flutter occurs. However, there occurs a critical flutter speed at which the oscillation can maintain itself and a critical speed beyond which the oscillation is damped out.

While this speed is constant, the elastic and aerodynamic forces put out each other, and the amplitude and frequency of the flutter remains constant. As the critical flutter speed is exceeded, however, the aerodynamic forces preponderate and the magnitude of the motion increases until structural failure occurs.

On Subsonic Wing-Airfoil Flutter—When the center of gravity of an airfoil does not coincide with its hinge axis, natural wing bending creates an alternating vertical motion of the airfoil hinge which, in turn, creates an angle of attack to the airfoil.

The airfoil is restrained from this flapping motion by the control cables but since there are also flexible airfoil surfaces, the airfoil responds to its own. The airfoil frequency may be above or below that of the wing so the airfoil oscillations will be either in phase with the wing oscillations, or out of a flapping hinge.

The airfoil frequency may even have a phase angle of 90 deg with that of the wing resulting in the airfoil being



In Jets, too, there are 36 places where Pesco PRECISION Equipment gives Positive Performance

Positive performance has always been a "must" for aircraft equipment. It's a major reason why Pesco precision fuel and hydraulic products have long been standard equipment on representing quality planes.

Today, the jet plane, with its higher speeds and consequently greatly increased fuel pressures and accuracy requirements, has placed even more emphasis on positive performance.

At these new extremes, Pesco has developed jet jet planes with vital equipment as the high-pressure fuel pump... the pump that is really the power in one of the 36 most important parts, another pump automatically goes into operation to keep fuel flowing constantly. So important was this development, that American's leading builders of jet airplanes have standardized exclusively on the Pesco high-pressure fuel pump.

Altogether, there are 36 Pesco products that can be used in 36 places on jet planes. They are listed on the right.

Working hard in hand with the aircraft manufacturer's own equipment, Pesco has kept constant pace with aviation's rapid advances. It is expensive and "know-how" that can be of real help to you. This advantage of it.

Also interesting places there are also 36 places where Pesco products are used.

KEY TO PESCO EQUIPMENT

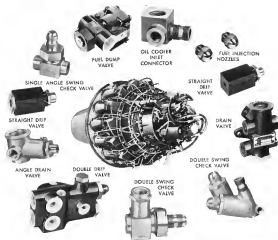
1. Fuel Injector Pumps (14)
2. High-Pressure Fuel Pumps—Engine-Driven (14)
3. Weyron Pumps (2)
4. Oil Separators (2)
5. Gasoline Relief Valves (2)
6. Pressure Relief Valves (2)
7. Master Motors for Cabin Ventilators (2)
8. Landing Gear Operations:
 - a. Engine-Driven Hydraulic Pump System
 - b. Electric Motor-Driven Hydraulic Pumps
 - c. Electric Motor Actuators
9. Electric Motors for Cabin Ventilation (2)
10. Motors for Engines to Operate Wing Slats (2)
11. Windmills for Hydraulic Systems (14)
12. Engine-Driven Hydraulic Pumps (2)
13. Motor-Driven Emergency Hydraulic Pump (1)
14. Motor-Driven Surface Reader Pump (1)
15. Hydraulic Valve Actuators (1)
16. Hydraulic Pressure Reducing Valves (2)
17. Hydraulic Pressure Relief Valves (2)

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Free Bibliography

A comprehensive bibliography on associated aeroelastic phenomena has been prepared especially for readers of Aviation Week. Address: Engineering Department, Aviation Week, 330 West 43rd Street, New York 18, N. Y.



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up when the wing is in the middle of its downward stroke. This causes a downward air force on the wing, with consequent instability.

► **No Slap-Check**—In solution to this problem is, of course, static balance but this is not simple. Lead balance weights have been used for many years to assure that the center-of-gravity of the aileron passes through the hinge line but the location of the weights is a critical consideration.

As the wing undergoes a selected flutter, the aileron balance weights can be swung up and down by a greater amplitude than those further inward. This brings about further inertia forces along the aileron leading edge.

This variation will induce a bend in the aileron leading edge which can produce aileron flutter and, in turn, wing aileron flutter. The ideal solution is the location of the aileron clevis and gravity axis along the hinge line but this is a complex design problem.

► **Seismic Response Flutter**—The problem of impedance flutter is complicated by two major factors elasticity of the fittings to which the impedance is attached, and the presence of the impedance in the wake of the wing.

The first factor introduces an additional bending and torsional mode, contributed by the fittings, to the bending and torsional modes of the air and stabilizer. Some studies have also included pitching of the aircraft, vertical translation of the aircraft, and wing bending is yet additional modes.

Thus, it is not possible to isolate tail surface flutter as the impedance. The problem should be considered as one of elastic or modal impedance flutter.

The presence of the wing wake creates a form of instability more clearly defined as buffeting, but in the same case these impulses are of a random nature and thus do not lend themselves to mathematical treatment and to design considerations.

► **Transonic, Supersonic Wing Flutter**—Introducing compressibility to the lift or pressure adds a whole new range of phenomena that must be considered. Flow changes over the wing associated with shock wave formation are much larger and more rapid than in the subsonic case. So flow air itself more conducive to the formation of disturbance forces.

However, the forward shift in the aerodynamic center brings this important area closer to the elastic and gravity axis of the wing so that the possibility of a single airfoil flutter is increased.

The subsonic wing wing has been one of the major contributing factors to the noise isolation of aircraft today as a means of noise control. As the noise factor is increased the effect upon the viscous distribution of wing bending becomes identified to that of straight

wing flutter. Both change the local angle of attack.

The concept, when the aileron is considered at a wing tip is lowered, the lift over that portion of the wing is increased. The wing tip bends up, striking is a reduction in an angle of attack of the wing as a whole and the upper slope of an aileron developed on the upper of the aileron. At a certain speed this downward will effectively cancel the upward of the aileron so that no rolling moment results. At a given speed complete aileron control is maintained.

Another important result of this bending of a wing tip is its effect on longitudinal stability. As the wing bends, the distribution of the angle of attack shifts in such a manner that the load is increased at the wing root and decreased at the wing tip. This causes a shift forward in the wing axis, increasing aileron and a moment around the center of gravity which is destabilizing. For example, in a high speed pull-out, wingtip bending leads to changes in the load.

► **Transonic, Supersonic Control Flaps**—In shock waves form over the wing or empennage, they react with the boundary layer to cause separation. The control surface is most severely affected with an attendant buffeting. In extreme cases, complete loss of control effectiveness results.

A phenomenon of the formation of shock waves over a wing, however, is that they occur initially at different times on the upper and lower surface. In transonic flow separation might occur over the upper surface and then the upper, followed by separation over the lower surface and its development.

Under these conditions, the flow at the trailing edge is characterized by rapid fluctuations which change the pressure distribution over the aileron with the same frequency. Two rapid fluctuations of the aileron has been termed "aileron buzz" is destabilizing at high subsonic speeds.

However, the aileron buzz can quickly establish aileron flutter if the conditions outlined in the subsonic case are obtained. This same phenomenon occurs over the trailing of the empennage at an increasing loading rate impinges on the tail surface. These aileron occur with a lower frequency however, and result in greater changes over the vertical tail surfaces that create a condition termed "jack-knife" but not pilots. Again, the oscillation is destabilized flow rather or elastic flutter but at very low frequencies but it can quickly establish flutter, as in the aileron case.

DIVERGENCE

A phenomenon that hinders but is caused little more is a new system

is important is the torsional deformation of a wing, an effect directly only. When the wing loads up and down it is twisted laterally, but when the load is only up or down it is twisted vertically.

Divergence actually is a wholly new dynamic phenomenon in that aerodynamic forces act on the twisting motion in its appearance. The torsional stiffness of a wing is made up of its elastic stiffness, which is independent of air speed, and its aerodynamic stiffness created by the variation in angle of attack due to twist.

► **Structural Flutter Ailard**—Divergence may only occur when the twist is such that the aerodynamic forces act and induce the total torsional stiffness of the wing to zero. At this point the wing twist will be uncontrolled and a further increase in speed will cause the divergence force to predominate over the restoring structural forces. The divergence will be increased until structural failure occurs.

The critical speed at which divergence occurs is a function of the impedance between the wing aerodynamic center and its elastic axis. Moving the elastic axis forward increases the divergence speed. Wings with the elastic axis forward of the aerodynamic center can only operate under divergence. In the transonic and supersonic case, in which large angles of sweep are used, the elastic axis is well forward of the aerodynamic center so that highly swept wings cannot diverge.

BUFFETING

A special form of impedance, attributable to the fluctuation in the tail loads caused by wing wake striking the empennage is called buffeting and is characterized by rapid changes in control forces.

A special form of buffeting occurs in all aircraft at a particular speed, known as the low-speed stall, but in this case the loads are low and need not concern the designer. Disrupted buffeting, on the other hand, is accompanied by extremely high loads that can cause structural failure.

► **Buffet Boundary**—Buffeting begins at certain combinations of Mach number and load factor termed "buffet onset diagrams." These combinations control the tail of the airplane gives the pilot an impression that it is being struck head on, some quick, and sharp, often slower but sustained.

These rapid changes in air pressure coefficients that are accompanied by high loads on the entire airplane structure. Therefore, the buffet boundary is normally a conservative limiting condition for safe aircraft operation. However, flight tests have shown that it is possible to exceed the buffet boundary for limited periods without structural

lines, and test pilots use a "flexible" burst of buffeting," which is not otherwise well defined.

Because of the equal and opposite forces of the buffeting loads, this phenomenon does not lead itself to substantial treatment. But more time "tolerable load" tests, the suggests that some improvements will be developed with sufficient accuracy for design purposes.

GUSTS

The increasing size, speed and wing loadings of aircraft emphasize the importance of fatigue in their "life expectancy." This latter size is governed largely by the probability of occurrence of a single load of such magnitude that the structure might be undamaged.

These considerations led to an estimate and continuing study of atmospheric gusts with respect to the frequency of their occurrence, their strength, atmospheric correlation associated with them; the loads imposed on aircraft by them and methods for their alleviation.

► **Gust frequency.**—On the basis of extensive records, it appears that an aircraft will fly through gusts at about 10 percent of its service life, about 1/10th time it will encounter gusts of definite intensity equal to about 11 chord lengths. Positive and negative gusts are about equal in magnitude and frequency. Available data on gust frequency permit approximate determination of their frequencies in the pressure structure of airplanes due to gusts.

However, the distribution of gust velocity along the span of a wing is not always uniform. Owing to the flexibility of the wing, accelerations created by gusts along the span.

Available data indicate that the maximum wing acceleration can be more than twice that of the loading and is more than twice the loading acceleration. The effect of such dynamic action is to cause superimposed stress loads at the outer portion of the wing with a maximum amplitude about 10 percent of that of the static stress for the aerodynamically distributed gust.

Since the natural period of wing increases in proportion to their size, and since the size of gusts to which the airplane will respond increases with airplane size, the ratio of natural period to period of application of load remains about constant for a given airplane. So the dynamic response of the structure does not appear to increase with airplane size.

IMPACT

An important error resulting from the usual assumption that the structure structure is a rigid body arises from the transient acceleration involved in the landing of an airplane. These dynamic loading loads now produce critical de-

sign conditions in the new large, heavy aircraft with more flexible structures.

► **Landing.**—The initial impact is applied to the airplane structure through the shock start in the form of a vertical force along the steel axis and a moment about the landing gear attachment point. The wheel exerts a drag force produced by the wheel spins up.

After the initial contact, a series of alternating loads is imposed on the structure. In the case of a modern three-engine commercial transport, the total number of these oscillations per landing run found to be approximately 30 for the vertical loads and 10 for the horizontal loads. Wing dynamic loads produce structural stresses almost as great as those in the fuselage. The oscillating energy, may be critical in severe impact.

These dynamic loads are most severe in the case of the drag load since the impact is an unbalanced force. In a centrally-located, well mounted in the vicinity of the main lines along the engine nacelle area.

STIFFNESS CRITERIA

The case for aerodynamic problems is well defined, in increased bending and torsional stiffness of the basic structure. But there are few structural factors that add more weight directly in proportion to their value, than stiffness.

The general aerodynamic problem is the determination of the optimum stiffness required to accommodate each of the various phenomena outlined above. The proper use of available knowledge of the types and magnitudes of each of the loads introduced by each variation in degree of each of these phenomena, a weighting mathematical analysis of the various loading conditions, and an assessment of the relative importance of each of these phenomena, are the basic considerations in the selection of their values required for the aircraft.

► **Stiffness.**—The problem is not a simple one, but a mathematical amount of weight still remains in the creation of a structure capable of resisting the loads and the aerodynamic forces imposed by the various phenomena. The problem is not a simple one, but a mathematical amount of weight still remains in the creation of a structure capable of resisting the loads and the aerodynamic forces imposed by the various phenomena.

► **Stiffness.**—The problem is not a simple one, but a mathematical amount of weight still remains in the creation of a structure capable of resisting the loads and the aerodynamic forces imposed by the various phenomena. The problem is not a simple one, but a mathematical amount of weight still remains in the creation of a structure capable of resisting the loads and the aerodynamic forces imposed by the various phenomena.

The various developments of the NACA for the past several decades, have drastically emphasized the importance of new smoothness and fairness and demands new wing stiffness criteria based upon the data of the present aerodynamic conditions. The new wing stiffness criteria are based upon the data of the present aerodynamic conditions. The new wing stiffness criteria are based upon the data of the present aerodynamic conditions.

these new criteria, but it substantially reduces the value of their output Mach number.

These requirements grow progressively more severe with aircraft designed for operation at high speed at high altitude at high load factors. A serious fault that leads to crash in the crash load is a failure that permits a straight edge to be loaded smoothly over the surface in a clockwise direction may be satisfactory for low drag and high critical Mach numbers at IG conditions.

At high speed, altitude and load factors, distortion of this surface can work havoc with the aerodynamic characteristics of this new wing. Adequate stiffness must be provided to accommodate load factors up to the critical Mach number of the basic profile.

► **Little Space.**—Air wings have grown progressively thinner and more flexible. The increased stiffness required has grown proportionately smaller. Since these stiffness loads almost touched each other, it was a logical step to put them, in a sense of classical mechanics, into a multi-cellular structure.

The final trend making the airframe responsible for increasing stiffness has introduced the desirability of tapered ribs to get structural efficiency and maximum weight design. However, this prevents the carrying pattern of open-weave structure in wing leading and forward structure which creates no mass structural problems.

The proper choice between stiffness and weight distribution requires a basic problem which will test the results of design.

► **Consistency.**—It is not just a matter of the new demands of aerodynamics. An other complex consideration is crash resistance of the isolated phenomenon. For example, crash resistance has an airframe loading on vehicle and crash resistance, has an important connection with faster and faster and reliability are becoming increasingly linked.

Such integration of formerly unrelated subjects eventually will be the chief work of aerodynamics to aerospace design.

New Process Saves Time and Material

A new process which permits casting of shrouded, high-speed impellers in the form of castings with built-in cooling channels of critical dimensions and surfaces that machining and balancing are almost totally eliminated, has been developed at the Turbineless, N. J. headquarters of the Ridge-Power division of Bendis American Corp.

Process, known as Bendis technique

of plaster mold casting, not only allows to make production requirements, but can be used to turn out parts of complex shape construction. It is especially well suited to the production of castings of complex shape, otherwise desired, will produce castings of complex shape on internal and external surfaces.

Since machining is minimized, and since castings are clean, complex parts, previously cut in sections to permit work on inner surfaces, now can be cast in one piece with considerable savings in time, labor, and material. Also, ability of process to produce thin, reinforced walls gives it added advantage of saving weight without loss of strength.

Impeller requirements actually show an increase in strength through use of impeller and point to improved performance areas of impeller where peripheral speeds up to 1500 ft/sec generate tremendous centrifugal forces.

From the result of an extensive development and research by the company's metallurgical and methods engineers, and can be applied to all low-temperature castings.

New Insulation Foam Stresses Low Weight

An extremely light insulating material that offers promise for use in aircraft applications, has been developed at Whittaker Laboratories, East Pittsburgh, Pa.

So light that it actually will float in water, foam is a plastic foam that expands to 100 times its original volume when heated. It weighs 10.2 lb/cu ft, less than the average density of a gas.

Foam is made from a synthetic phenolic resin and looks like a sponge. It is resistant to heat, moisture, fungus growth, and insects.

In reported low cost makes it possible for many applications.

The plastic, in a liquid state, is mixed with a powder and heated at 550 F. for about 15 min. As the liquid expands into foam, it traps thousands of tiny bubbles. These bubbles, air bubbles in the solidified foam is exposed to the atmosphere.

After processing, the material retains a part of its weight in about 100 parts of air. Then is reported to make it the lightest solid known in state of weight to volume.

Another advantage is claimed with respect to shipment and storage problems encountered with some insulating materials. The plastic foam can be loaded in a liquid in a barrel and fused where needed.

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ACTUATOR



VALVE BODY

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Thinned-out oil may starve engine parts



Close tolerances require good lubrication.

You probably know that when oil temperature goes dangerously high, the lubricant becomes dangerously thin. Oil that is too cold, on the other hand, will not circulate freely, may "starve" some parts and expose them to scoring. So it's a good policy first to learn the maximum and minimum oil temperature limits for your engine—and then select the proper grade of RPM Aviation Oil that will give best protection over a wide temperature range.

Special insulating material reduces pre-ignition

The best spark plugs operate at high engine temperatures without overheating or causing pre-ignition. You'll find this a prime characteristic of Atlas Champion Aircraft Spark Plugs. For a special in-

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to that device eliminates current times when idle, and also short runs without switch and, but, automatically. Another feature is that by closing on differential voltage between generator and bus, rather than at fixed voltage, the current decreases further on opening. Conforming to AF Specification AN-5-11a, device is designed for rated operation from sea level to 50,000 ft. at ambient temperatures ranging from -67 to 160 F. In addition to use in reverse current control, it can also be used satisfactorily as starting contactor for auxiliary powerplants which are started by applying voltage to generator. Use requires space of 4 in. cube, weight approximately 25 lb.

Checks Antennas

Rectangular coilshaped winding system, type AIL 375, used presently in determining directional characteristics of radio antenna is manufactured by Airborne Instruments Laboratory, Inc., Alhambra, N. Y. Apparatus can also be used to reveal light, ultraviolet, sound pressure, and heat levels at writing rates reported to be higher than formerly available. It's claimed that resistor characteristic between printed circuit plate, previously required to determine whether antenna was actually performing as accordance with design specifications. Construction related plate affords more power storage and increases the accuracy of measurement. System consists of selective amplifier, pen and paper servo amplifier, power supply, and a reader.



For Coffee Aloft

High altitude, automatic coffee-maker is intended to eliminate need for thermos coffee or heating coffee at low temperature. Features of reduced atmospheric pressure. Made by High Altitude Coffee Maker Co., 1013 Alameda St., Palo Alto, Calif., unit comes in 24 and 5 gal. sizes, will use changeable heating and adaptable to a.c. or d.c. of varying voltages. Making consists of two main chambers, upper for water storage and heating, lower for heating bucket and coffee reservoir. Coffee can be made in small batches. It doesn't temperature is controlled under pressure. Weight of 5 gal. model, designed for bulkhead mounting, is 18 lb.

Cleans, Dries Gases

For liquid separation, agitation, drying and drying and for automatic and pneumatic mechanisms requiring positive maintenance of air or gas. Liquid separator is offered by Sales Corp. of America, Tulsa, Pa. Device removes water and a variety of carbonaceous compounds and continuously from compressed air or gas lines. Phase separation and liquid action are accomplished by two streams which are water-soluble, the other water-soluble, but are immiscible. Compressed medium passes through first tube where it is stripped of aqueous contamination and dirt. Moisture drops in bottom and flows through the second tube without loss of air. Device also acts as filter, removing any atmospheric dust and solid particles faster than 100 microns in diameter. Unit consists of three main parts with water injection rate ranging from 3.2 to 74 lb. There are no moving parts, traps, valves or diaphragms. Maintenance is limited to removal of accumulated dirt.



Aircraft Control Relay

Delivered at voltage type guarantees control relay for aircraft and stationary perceptive applications is manufactured by Hazen Electrical Mfg. Co., Akron, Ohio. Model AN-50 is designed to operate with d.c. generator having maximum capacity of 300 amp and second regulated voltage of 28.5. Class



Fluid-Supply Aid

New heavy duty transfer pump for nonlubricating liquids, developed by Yale & Towne Mfg. Co., Swanton, Conn., is offered as especially suitable for handling acetone, gasoline, oil, solvents and similar materials, at differential pressures of 50 psi and below. Pump may be equipped with solid or semi- or variable volume control type heads, making it adaptable to wide variety of requirements. Heads are interchangeable. Unit is available in 10, 90 or 100 gpm sizes.

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tion engine. Metal propellers require tremendous loading and Model changes are more expensive.

In earlier reports on gains by Cessna in recent flight tests with a square-tipped experimental McCauley propeller, said to attack the engine noise problem, flight tests indicated a small gain in efficiency over the round-tipped propeller, and an apparent slight reduction in noise. Without detailed modeling, it was concluded that the efficiency of the square-tipped propeller was not in a more acceptable range than that of other propeller types. Considerable gain in efficiency was expected over that from a fixed pitch four-blade wood. Research propeller on the Cessna 170 four place plane.

► **PAI Plant**—Memphis the small but highly competent engineering staff of Aeronautical Research Foundation at Dayton, is continuing great engine research, using as a power pig Goodrich's three-stage turboprop engine.

With earlier tests virtually completed on conventional tractor two plane and four-place Stinson and Piper planes, Perforator Otto Köppen, Jim Taylor and Loren Ballinger wanted to see how their combination of an engine with reduction gear and variable pitch four-blade propeller turned over.

So Kinnear has turned out another four-blade fixed pitch prop of 56 in diameter which has already been installed on the Goodrich plane. Later, the Goodrich propeller will go through a series of tests with the adjustable propeller which accommodate five, three, two, or one blades, for a complete series of readings on its noise. Amount of reduction of noise is expected to be greater than in either the Stinson or Cessna since the Goodrich engine reflected by some reduction in probable the nearest airplane of its size, with the probable exception of the Republic Seabee which may further outclass.

Ballinger and Köppen are also working on the same problem with the 8100 also having a variable propeller they are using on their new Dihedral Cessna 170. Also has a private venture set up with the Aeronautical Research Foundation.

► **Midwest Progress**—Some of the most extensive propeller development work has been in the Goodrich and Continental lines.

Reductions are that some of the best of these wood designs or some other new design may be successful even in all-metal propellers. Only a metal propeller need thus be the most violent noise have been. McCauley propellers of newly standard design, occasionally with square tip modification.

Liberalized Copter Regulations Seen

Lenient regulations governing rotary wing craft operations in close built-up areas are indicated by a Civil Aeronautics Board decision last week.

The Board decreed a case filed against Charles Matthews, Arizona, says helicopter pilot, charged with operating a Bell helicopter in a careless or reckless manner. He landed in a downtown Tucson business district with a crowd of several hundred spectators.

Mattures' appeal of the adverse finding of a CAB examiner and CAB ruling that the pilot had taken "only reasonable precautions" in making adverse arrangements with the police department and a local crowd going to neutral the crowd to avoid its attack. The finding of the examiner regarding Matthews' license for 90 days was overruled.

Board decision is regarded as a support to CAA's Office of Aviation Safety toward more liberal interpretation of stipulations in the future.

Weather Survey

Sealing improvement in weather reports to nonmilitary flight. Flight Safety Foundation, Inc., is distributing 2000 potential questionnaire report forms.

Companies and individual owners of aircraft are asked to report discrepancies between weather reports received and actual weather encountered in flight. U. S. Weather Bureau has promised to investigate discrepancies reported. Cooperator Aircraft Owners Assn. has offered to distribute cards to its members.

Aircraft Owners & Pilots Assn. has been conducting a nonsectarian similar postal survey on weather report discrepancies among its members for some time.

Both surveys are based on frequent pilot complaints of wide variations experienced between weather forecasts and weather actually encountered in flight.

Airstrip Tower

A control tower on the Chicago lake front airport on Northside Island is expected to be in operation late this summer.

Tidal operations of the strip from opening date Dec. 10 to Mar. 31 were 1675 arrivals and 1632 departures. Much operations averaged 47 a day. A DC-10 is the largest plane to land on the strip.

CAA support limitations on the strip forced its use under strong criminal conditions.

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Domestic Trunkline Operations

(First Quarter 1949 and 1948)

	Rev. Per Mile (Adt. 086)		Net Income		
	1949	1948	Per Change	1949	1948
American	303,156	224,821	+36	\$126,312	\$5,051,207
Boeing	41,278	30,254	+37	(174,096)	(220,230)
Capital	32,273	48,074	-33	(490,149)	(2,241,510)
C&D	27,343	21,815	+25	(84,215)	(104,796)
Continental	3,285	6,627	-50	(119,472)	(14,268)
Continental	12,125	11,204	+8	(149,815)	(86,381)
Delta	35,281	49,790	-30	218,438	(511,878)
Eastern	267,284	271,516	-1	1,711,248	1,420,901
Island	3,515	3,981	-12	26,484	(25,028)
Midwest	25,811	18,217	+41	2,482	(504,674)
National	49,176	16,195	+204	681,377	(779,890)
Norfolk	16,268	8,425	+94	(181,357)	(324,125)
Norfolk	38,566	71,131	-46	(1,786,661)	(1,374,171)
TWA	177,697	181,284	-2	(2,962,312)	(1,455,494)
United	257,598	180,614	+44	(3,455,042)	(1,801,791)
Waters	21,475	21,819	-2	(151,510)	(854,553)
Totals	1,157,538	1,154,212	+3	\$8,968,770	\$15,400,600

(CAA figures. Scheduled operations only)

Percentages indicate deficit

Airline Earnings Stump the Experts

In the face of a general business slump the carriers continue to cut deficits and increase revenue mileage.

By Charles Adams

The steady upward trend of airline traffic and earnings at a time when general business activity is slackening continues to stump the experts.

While last year's predictions of substantial traffic gains caused the industry's economic forecasts to be set to go out on another limb at the start of 1949, but with first quarter results far ahead of 1948, airline executives are again expressing cautious optimism.

Classifying Factors—Better regulatory, trade fare, economy service, and the unprecedented safety record apparently have helped importantly in the recent traffic boom. Higher fuel prices are also helping revenue.

Scheduled revenue passenger mileage flown by the 16 domestic trunklines during first quarter 1949 was up 15.7 percent over the same time last year, and the net loss cut to less than 57 million. The carriers were \$14.5 million in the red at the end of the first three months of 1949 and were unable to wipe out the deficit during the usually profitable summer months.

First Quarter Profits—Three of the 16

domestic trunklines reported gains as passenger business for first quarter 1949. Five of the companies were in the black for the period. Last year, only Eastern Air Lines made money in the first quarter.

The airlines are not sharing in the airlines' passenger traffic upturn. Airs of American Railroads estimates now estimate that net passenger business this year will be 12.8 percent under 1948. Unless they find a way to a drop of only 11.4 percent.

(Relative Company Comparison) announced that month that the net loss had shown a profit as their passenger service in only four of the past 13 years—1942 through 1946. Last year their passenger deficit was \$560 million.

AA Sets the Pace—American Airlines is continuing to pace the air transport industry's comeback. April earnings wiped out AA's small first quarter domestic net loss of \$135,000.

President C. R. Smith has colored stockholders that the company would show a profit for 1949 if business no longer remains at present levels. Last year American's domestic net loss for the first quarter was over \$5 million.

AA's 35 percent increase in revenue passenger mileage in first quarter 1949 not only gave the outstanding performance in the industry. Its April passenger traffic was 13.7 percent ahead of the same month last year.

National Airlines' revenue passenger mileage during first quarter 1949 was 23.5 percent ahead of 1948. But NAL was crippled by a strike most of last year.

Western—Eastern—Northwest Airlines President Cecil Hewitt has told his company's stockholders that while it is still too early to tell how successful the summer season will be, "optimism is justified by the gains in revenue and reduction in costs experienced during the first quarter. We can be sure of one thing—the first half of 1949 is a much better position than we closed the first half of last year."

NWA cut its domestic net loss from \$1,972,000 in first quarter 1948 to \$1,948,000 in first quarter 1949. Its Orient service showed a small profit.

In April, with the help of its new transcontinental coach service, Northwest's passenger traffic soared 21 percent above last year. Domestic passenger revenue was up 37 percent in April, and NWA is expected to show a profit for the month.

Without the skyrockets, Northwest's domestic revenue passenger mileage during first quarter 1949 rose only 3 percent over the same 1948 period.

Dakota—Optimistic—Western Airlines has a good chance of showing a net profit in 1949 with a 31 percent load factor increase. It cut its losses its period level of costs and net rates, according to President T. C. Dickinson. This forecast was made on the basis of first quarter results showing a net loss of \$750,000 compared with \$554,000 in the same 1948 period.

WALA's domestic passenger mileage was down 6 percent from the first three months of last year. Part of the decline is believed due to the focus company's gains Western by cut-rate unprofitable carriers on the Los Angeles-San Francisco run.

The California legislature is now considering a bill which would require a certified union to prove the need for their service and get a certificate from the State Public Utilities Commission.

United—Despite a 24 percent gain in revenue passenger mileage, United Air Lines had a \$3,616,000 net deficit on domestic operations in first quarter 1949—highest in the industry. In the same period last year, UAL's net domestic loss was \$3,411,066, a figure which was later cut sharply by retroactive mail payments.

Company officials noted that the retroactive mail payments, equalization of costs on grounded DC-6s, higher fuel

THE TEXAS COMPANY Offers FOR SALE EXECUTIVE DC-3

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EDITORIAL

Give Air Freight Its Chance

Except for its regrettable failure to include *Willis Air Freight* in its approach, the Civil Aeronautics Board's decision granting tentative certificates to four all-cargo operations is commendable.

The excellent record of *Willis* deserved more consideration than it received from the Board, and *American West* expects to have cause to say so in this subject ultimately.

The Board's inaction on overhauling these independent carriers is conspicuous, in light of the strong opposition of the more scheduled airlines. Some of these airlines complain how odd every possible legal excuse to defer this case. As long ago as last July, *Shink Airways* listed 38 principal delay maneuvers. The campaign is still underway.

Brady, the complainants say, felt there is not enough airfreight business to sustain all carriers. Then they contended that the new lines will rob the old carriers of an important new revenue source which in turn will add to the taxpayer's costs in mail subsidies.

All of this may prove to be true, but we doubt it. No means of transportation has ever reached maturity yet to be reversed and maturity until it becomes a mass carrier of freight. So far, commercial aviation's freight business has been negligible. And the pioneers like *Slick*, flying *Tigra*, *Willis* and the others did most of the spade work in launching the air freight industry we do have. We believe the potentials of air freight are enormous. We believe that specialists in air freight—who are not interested in passenger transportation—have done and will continue to do a better job of transporting and developing freight business than others. Furthermore, they do not ask a dollar of subsidy from the government in their rates.

Until the government uprates mail rate subsidy payments from straight service compensation, the American taxpayer will never know how much of the mail pay is going into subsidizing low cargo rates or inefficient passenger service. The passenger airlines themselves do not know what their cargo transportation costs are. The air cargo carriers know down to the last tenth of a cent. Air cargo transport, like any other business, must be conducted on a business basis. Let's start it off on a business basis.

Certification of the all-cargo lines, for a five year period, will enable these companies to start serious air cargo development, including the design, production, and purchase and operation of the most efficient freight aircraft the current state of the art permits. It will enable these companies to start building permanent sales organizations which attract high caliber salesmen. It will give this country the important trend attachment of a highly

efficient air cargo system at minimum cost from the taxpayers.

We hope CAA delays this case no more. It should make these certificates effective June 24, in accordance with the date in the tentative decision. If after five years the air freight system proves to be a failure, and in added stress on the taxpayer without adequate return, then and only then will it be time to turn the transportation of freight back to the passenger airlines.

Minimum commercial air freight development should bring the greatest expansion of peacetime aviation this country—or the world—has ever seen. Give air freight a chance to show what it can do. No more stalling, please.

Memo

From an Aviation Week Editorial Mr. B:

"...There are men and mechanical test apparatus qualified to resolve the dispute. Before we spend another dollar, why not ascertain the exact and detailed performance of the B-36? Assemble a neutral group whose qualifications will satisfy all concerned. Put the big ship through a thorough-going flight test program. The results need not be made public but the Secretary of the Air Force and the Secretary of Defense should get the facts. Once such results are compiled and all interested parties are apprised, there could be no foundation for rumors, no question of whether to huge full speed ahead on development or abandonment (of the B-36), no likelihood of Congressional investigations. Let's kill the rumors now, let's kill the controversy before it really gets underway. If we don't kill it now, the battle may get out of control completely."

From the Same Issue of Aviation Week, Page 7:

"One of the questions raised in the recent B-36 vs. fighter controversy is: Why has the Navy set apart is queried to get the best of its current fighter crop against the *Convair* bomber?"

From a Washington Dispatch of the United Press May 17:

"The House Armed Services Committee has ordered the Defense Department to conduct 'impartial tests' of the Air Force's B-36 against the Navy's best jet fighters. The showdown test was ordered after the Navy claimed unofficially that it has a jet fighter that can intercept and shoot down a B-36. It had challenged the Air Force to put the B-36 to a test but the Air Force had assumed silent Chairman Vinson told his committee it was time the American people got a satisfactory answer to the controversial question whether the so-called bomber is, in the Air Force's opinion, almost impossible to intercept."

—ROBERT H. WOOD

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Engine builders and aircraft manufacturers are urged to let this worldwide combination of engineering experience and manufacturing facilities help solve their problems.

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Now operating 300 hours before overhaul, Allison J33 jet engines offer more useful service in the air with less lost time on the ground for service and repair.

Air Power is Peace Power

★ ★ ★

Other Allison-powered airplanes:
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North American F-51 Fury
Northrop YB-49 Flying Wing
Grumman F6F-3 Panther



J33-A-23 turbo-jet

Allison

Builder of axial and centrifugal
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